Amendments to the Claims:

- 1. (Original) 1. A data storage system including a cache comprising a variable number of levels, each level having a cache controller and a cache memory wherein means are provided for address mapping to be recorded and applied between each level of the cache.
- 2. (Original) A data storage system as claimed in claim 1, wherein the means for address mapping are provided for a level between that level and the level above in the cache.
- 3. (Original) A data storage system as claimed in claim 1, wherein the cache includes means for creating a new level in the cache above an existing level and means are also provided for tying an address mapping to the existing level.
- 4. (Original) A data storage system as claimed in claim 1, wherein the address mapping between the levels of the cache corresponds to a point in time virtual copy operation which has been committed to the cache in electronic time.
- 5. (Original) A data storage system as claimed in claim 4, wherein a new level is created in the cache when a point in time virtual copy operation is committed to the cache.
- 6. (Original) A data storage system as claimed in claim 4, wherein a plurality of point in time virtual copy operations are tied to a single level provided the point in time virtual copy operations do not conflict with any intervening writes to the cache.
- 7. (Original) A data storage system as claimed in claim 1, wherein the cache includes means for deleting a level of the cache including means for destaging data from the level to underlying storage devices.

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- 8. (Original) A data storage system as claimed in claim 1, wherein lower levels of the cache are destaged before upper levels and after a level is destaged, the address mapping recorded for a destaged level is applied to underlying storage devices.
- 9. (Original) A data storage system as claimed in claim 1, wherein the data storage system also includes a processor and memory, and underlying data storage devices in the form of an array of storage devices having a plurality of data blocks organized on the storage devices in segments distributed across the storage devices, wherein when a data block in a segment stored on the storage devices in a first location is updated, the updated data block is assigned to a different segment, written to a new storage location and designated as a current data block, and the data block in the first location is designated as an old data block, and having a main directory, stored in memory, containing the locations on the storage devices of the current data blocks.
- 10. (Currently Amended) A data storage system as claimed in claim 9 ± 4 , wherein the data storage system is in the form of a log structured array and the point in time virtual copy operation is a snapshot copy operation.
- 11. (Original) A data storage system as claimed in claim 4, wherein the point in time virtual copy operation is a flash copy operation.
- 12. (Original) A cache comprising high-speed memory, the cache having a variable number of levels, each level having a cache controller and a cache memory, wherein means are provided for address mapping to be recorded and applied between each level.
- 13. (Original) A cache as claimed in claim 12, wherein the means for address mapping are provided for a level between that level and the level above in the cache.
- 14. (Original) A cache as claimed in claim 12, wherein the cache includes means for creating a new level in the cache above an existing level and means are also provided for tying an address mapping to the existing level.

- 15. (Original) A cache as claimed in claim 12, wherein the address mapping corresponds to a point in time virtual copy operation which has been committed to the cache in electronic time.
- 16. (Original) A cache as claimed in claim 15, wherein a new level is created when a point in time virtual copy operation is committed to the cache.
- 17. (Original) A cache as claimed in claim 15, wherein a plurality of point in time virtual copy operations are tied to a single level provided the point in time virtual copy operations do not conflict with any intervening writes.
- 18. (Original) A cache as claimed in claim 12, wherein the cache includes means for deleting a level of the cache including means for destaging data from the level to an underlying storage system.
- 19. (Original) A cache as claimed in claim 12, wherein lower levels of the cache are destaged before upper levels and after a level is destaged, the address mapping recorded for that level is applied to an underlying storage system.
- 20. (Original) A cache as claimed in claim 15, wherein the point in time virtual copy operation is a snapshot copy operation.
- 21. (Original) A cache as claimed in claim 15, wherein the point in time virtual copy operation is a flash copy operation.
- 22. (Original) A method of data storage comprising reading and writing data to a cache having a variable number of levels, wherein the method includes recording and applying address mapping between each level of the cache.

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- 23. (Original) A method of data storage as claimed in claim 22, wherein the address mapping is provided for a level between that level and the level above in the cache.
- 24. (Original) A method of data storage as claimed in claim 22, wherein the method includes creating a new level in the cache above an existing level and tying an address mapping to the existing level.
- 25. (Original) A method of data storage as claimed in claim 22, wherein the address mapping between the levels of the cache corresponds to a point in time virtual copy operation which has been committed to the cache in electronic time.
- 26. (Original) A method of data storage as claimed in claim 25, wherein the method includes creating a new level in the cache when a point in time virtual copy operation is committed to the cache.
- 27. (Original) A method of data storage as claimed in claim 22, including the steps of: writing data to a first level of the cache until a point in time virtual copy operation is committed to the cache; recording the mapping defined by the point in time virtual copy operation; tying the record to the first level; creating a second level of the cache; writing subsequent writes to the second level of the cache.
- 28. (Original) A method of data storage as claimed in claim 26, wherein a plurality of point in time virtual copy operations are tied to a single level provided the point in time virtual copy operations do not conflict with any intervening writes to the cache.
- 29. (Original) A method of data storage as claimed in claim 25, wherein the point in time virtual copy operation is a snapshot copy operation.
- 30. (Original) A method of data storage as claimed in claim 25, wherein the point in time virtual copy operation is a flash copy operation.

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- 31. (Original) A method of data storage as claimed in claim 22, including the steps of: receiving a read request in the cache; searching a first level of the cache for the read; applying the address mapping for the next level to the read request; searching the next level of the cache; continuing the search through subsequent levels of the cache; and terminating the search when the read is found.
- 32. (Original) A method of data storage as claimed in claim 31, including the step of remapping a read request by applying all the address mappings of the levels of the cache to the read request and applying the remapped read request to an underlying storage system.
- 33. (Original) A method of data storage as claimed in claim 22, wherein the method includes deleting a level of the cache including destaging data from the level to underlying storage devices.
- 34. (Original) A method of data storage as claimed in claim 22, including the steps of: destaging data from the lowest level of the cache to an underlying storage system; applying the address mapping for the lowest level to the underlying storage system; deleting the lowest level of the cache.
- 35. (Original) A method of data storage as claimed in claim 22, wherein the data storage is arranged as a log structured array storage subsystem including a write-back cache.
- 36. (Original) A computer program product stored on a computer readable storage medium, comprising computer readable program code means for performing the steps of reading and writing data to a cache having a variable number of levels, recording and applying an address mapping between each level of the cache.

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